



RESEARCH ARTICLE

Morphoanatomical Studies of *Cassia occidentalis* Linn. (Leguminosae)

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ABSTRACT

Scientific characterization of medicinal plant species is fundamental for assessing their taxonomic identity and therapeutic potential. The present investigation documents the morphological and anatomical attributes of *Cassia occidentalis* L. (Kasondi), with emphasis on vegetative structures and vessel element features. Seed and leaf extracts were subjected to phytochemical screening, free amino acid profiling, and mineral analysis to evaluate their bioactive and nutritional constituents. The integrated data provide a pharmacognostic framework for the species and substantiate its recognized ethnomedicinal applications.

Keywords: *Cassia occidentalis*, Kasondi, Morphology, Anatomy, Phytochemical analysis, Pharmacognosy

INTRODUCTION

Nature has been a rich source of medicinal agents for thousands of years, and many modern drugs have been derived from natural products (Shinde, 2014). The acceptance and use of herbal medicines have grown significantly in contemporary healthcare. According to the World Health Organization, nearly 80% of the global population relies on plant-based remedies as their primary form of treatment (Barnes & Anderson, 2007). However, the rising demand for herbal products has also led to frequent adulteration, posing risks to consumers and manufacturers and making the global herbal market increasingly unsafe (Folashade *et.al*, 2012). The seeds of *Cassia occidentalis* are the main part used medicinally, although its leaves and roots also hold therapeutic value. The roasted seeds serve as a coffee substitute, and the plant contains several Phyto-active compounds that support its wide use in traditional medicine (Francis, 2002).

Traditionally, the whole plant is used as a purgative and general tonic. The seeds and leaves are applied for various skin ailments (Yadava & Satnami, 2011), while the roasted seeds are used in Ghana for managing hypertension. The plant is also used for fever, menstrual disorders, tuberculosis, anaemia, liver ailments, and general weakness (Usha *et.al*, 2007). The leaves are applied externally for wound healing, itching, bone fractures, ringworm, and throat infections, and the plant has also been reported to cure leprosy. A bark infusion is used in folk medicine for diabetes (Reeta & Ravindra, 2013). Several studies have reported antimicrobial, antioxidant, hepatoprotective, antimalarial, larvicidal, anti-inflammatory, antidiabetic, antianxiety, antidepressant, analgesic, antipyretic, and immunosuppressive activities of the plant. The leaves are used internally and externally for skin diseases such as scabies and ringworm. A hot decoction is preferred for its tonic effects, and leaf paste mixed with calcium hydroxide is applied to abscesses for rapid healing (Mugisha & Origa, 2005; Veerachari & Bopaiah, 2012). Leaf paste is also used for wounds, sores, fever, throat infections, tuberculosis, asthma, rheumatism, haemoglobin disorders, and diabetes (Krithikar & Basu, 1999; The Wealth of India, 1998). The leaves and roots are components of several herbal liver tonics and remedies for liver disorders. The plant is traditionally used for insect bites, snakebite, constipation, oedema, inflammation, and rheumatism (Tropical Plant Database, 2008). The roots, leaves, flowers, and seeds act as laxatives and purgatives (Todd, 1967). The plant is also employed as a febrifuge, vermifuge, anticonvulsant, and in the treatment of chicken pox, guinea worm, and black quarter disease (Mann *et al.*, 2003; Saganuwan, 2006). Leaf infusion is considered an effective remedy for hepatitis

(Onakpa & Owoleke, 2010). In Unani medicine, the plant is used as an antidote for poisons, a blood purifier, expectorant, anti-inflammatory agent, and a treatment for liver disorders (Nadkarni, 1976). In India, it is used for haematuria, rheumatism, typhoid, asthma, and haemoglobin disorders (Frodin, 2004; Singh *et al.*, 2013). All parts of the plant possess medicinal properties (Frodin, 2004). *Cassia occidentalis* contains several important bioactive compounds, including sennosides and anthraquinones (pods), dianthronic heterosides (leaves), apigenin (pericarp), emodol (roots), β -sitosterol (flowers), and volatile oils (leaves, roots, and seeds). These constituents contribute to its therapeutic potential and support the body's natural defense mechanisms (Khare, 2004; Yadav *et al.*, 2010; Vijayalakshmi *et al.*, 2013; Ngombe *et al.*, 2019). In Amravati district the hakims used the roots and seeds as an antidote for snake bite (Ahmad, 2004).

MATERIAL AND METHODS

For anatomical studies, the plant specimens were preserved in 70% FAA, and hand sections of root, stem, and leaf were taken. Vessel studies were carried out by treating thin slices of mature roots and stems with macerating fluid (5% HNO_3 and 5% $\text{K}_2\text{Cr}_2\text{O}_7$) for 12–24 hours. The material was washed, stained with 1% aqueous safranin, and vessel elements were measured using an ocular micrometer. Camera lucida sketches were prepared, and the vessels were classified following Radford *et al.* (1974).

For phytochemical analysis, mature plants were shade-dried, powdered, and stored at 4°C in airtight bags. Samples were qualitatively tested for bioactive compounds (Harborne, 1973; Gibbs, 1974; Peach & Tracey, 1979; Kokate *et. al.*, 1990; Evans, 1996). The presence of compounds was recorded as + (weak), ++ (moderate), or +++ (strong). Amino acid profiling was performed using two-dimensional chromatography (Lederer and Lederer, 1957; Harborne, 1973).

Plant ash was prepared at 400°C (AOAC, 1975), and ash values were estimated following Kulkarni and Apte (2000). Mineral elements were detected qualitatively (Johannson, 1940) and quantified using a flame photometer. Epidermal features were studied along with trichomes and stomata were documented.

Macromorphology

The plant is an annual undershrub, reaching a height of 30–160 cm. The branches are purplish and distinctly furrowed. The leaves are foetid, unipinnate, and measure 10–20 cm in length. They are exstipulate, with a grooved rachis bearing

a single large globular gland at its base. Leaflets occur in 3–5 pairs; they are ovate-lanceolate, acute, entire, with thin pubescence on the lower surface. The petiolules measure 2–5 mm. The inflorescence is axillary or terminal, consisting of a shortly pedunculate, few-flowered corymbose raceme. With maturity, the peduncle may elongate further. The flowers are pedicellate, with pedicels that lengthen in the fruiting stage. Bracts are present but caducous. The calyx comprises five unequal, pale whitish sepals. The petals are unequal, 10–13 mm long, yellow, and marked with red veins. The androecium consists of seven fertile stamens of unequal size, each dehiscing by a single large apical pore, along with three staminodes. The ovary is compressed and elongated, with marginal placentation. The pod is 10–13 cm long, laterally compressed, and distinctly septate between the seeds. Each pod contains approximately 20–30 discoid seeds, which are dark olive green and shiny. (Plate 1:Fig.1-7)

Micromorphology

Root triarch. Pith absents. Secondary growth normal. Vessels large, rays uniseriate mixed with bi- & triseriate short rays. Cork superficial. (Fig. 8). Roots vessels (Fig. R1-R3). Extremely small (Class A): 81 – 162 µm long, 46 – 173 µm broad, medium size (Class D) 377 µm long um broad.

Stem with distinct ridges and furrows. Epidermis single layered, cells contain anthocyanin; hypodermal collenchymatous patches below the ridges & chlorenchymatous below the furrow. Cortex parenchymatous, 2-3 layered. Pericycle parenchymatous becoming sclerenchymatous with age. Vascular bundles conjoint, collateral, open, arranged in a wavy ring. Pith large. Continuous ring of cambium gets established at early stage when internode is still undergoing elongation. (Fig. 9).

Secondary growth normal. Vessel solitary or arranged in uniseriate tyres. Rays abundant, uniseriate, pith cells store abundant starch. (Fig. 10). Stem vessels (Fig. S1-S7)

Extremely small (Class A): 154 - 162 um long 58 – 104 µm broad Very short (Class B) 200 – 215 µm long 27-77 µm broad medium size (Class D) 481 µm long 38 µm broad.

Node trilacunar three traces. (Fig. 11)

Pulvinous receives three traces, lateral one branches, branch going to stipules. Pulvinus traces further branch and all the traces get arranged in irregular ring. From ring traces are given to gland. (Fig. 12a-c).

Petiole triangular with deep groove on upper surface. On the two sides of groove tissue extends to form sort of wing on each side. Epidermis single layered; cuticle thick:

hypodermal collenchymatous patches present below the angle. Ground tissue parenchymatous. Distinct endodermis & sclerenchymatous pericycle present. Vascular bundles arranged roughly in a ring below the pericycle. To some extent secondary growth is also seen here. Wings of petiole also receive two traces which first merge to form single trace & then to form 3 traces below the lamina. (Fig. 13).

Rachis Anatomical structure of rachis is exactly similar to that of petiole. (Fig. 14).

Petiolule 2 traces enter the petiolule base; they first unite and then branch into three. (Fig. 15).

Lamina dorsiventral, amphistomatous. Epidermal cells shallowly sinuous, those of upper epidermis somewhat angular, stomata paracytic, subsidiary cells unequal especially in the lower epidermis. Frequently anomocytic stomata also recur in lower epidermis. Mesophyll consisting of single layered palisade & 5-6 layered spongy parenchyma. All the cells of mesophyll with abundant chloroplasts. (Fig. 16-18).

Midrib with single large vascular bundle surrounded by sclerenchymatous sheath. Ground tissue parenchymatous. (Fig. 19).

Trichomes Old parts glabrous. Young stems show multicellular scales (which appear as white spot to naked eye) and unicellular hairs. (Fig. 20-21).

Crystals - Sphaeraphides present in the parenchymatous ground tissue of different organs.

Phytochemistry

The following chemical constituents were found to be present in leaves and seeds of *Cassia occidentalis* L.:

Sr. No	Phytochemical Constituent	Present/ Absent Leaves	Present/ Absent Seeds
1	Alkaloids	+++	+
2	Acubins & Iridoids	+	+++
3	Cardenolides	+	+++
4	Leucoanthocyanins,	+	+
5	Steroids/ Triterpenoids	+++	+++
6	Flavonoids (Shinoda Test)	+++	-
7	Flavonol Test	+	-
8	Anthraquinones	-	+

The free amino acids and minerals found in the leaves are given in the table:

S. No.	Amino Acids	Minerals
1	Alanine	Sulphur +
2	DL - Alanine	Calcium +
3	Glucosamine – HCL	Magnesium +
4	Glycine	Iron +
5	Cysteic acid	Chlorine ++
6	Proline	Phosphorus +++
7	Valine	Sodium +
8	DL-2 amino n-butyric acid	
9	Isoleucine	
ASH AND PHYTOCHEMICAL ANALYSIS		
1	Yield of the ash	882 mg/gm
2	Acid Soluble ash (HCL)	746 mg/gm
3	Acid Soluble ash (HNO ₃)	726 mg/gm
4	Acid Insoluble ash (HCL)	136 mg/gm
5	Acid Insoluble ash (HNO ₃)	156 mg/gm
6	Sodium	20.33 mg/gm
7	Potassium	225 mg/gm
8	Calcium	103.65 mg/gm

The free amino acids and minerals found in the seeds are given in the table

Sr. No	Free Amino Acids	Minerals
1	Aspartic acid	Sulphur +
2	Tyrosine	Calcium +
3	Glucosamine – HCL	Magnesium +
4	Argenine	Iron +
5	Cysteic acid	Chlorine +++
6	Proline	Phosphorus +
7	Valine	Sodium +++
8	Histidine/Hystine mono hydrochloride	
9	Iso-leucine	
ASH AND PHYTOCHEMICAL ANALYSIS		
1	Yield of the ash	936 mg/gm
2	Acid Soluble ash (HCL)	576 mg/ gm
3	Acid Soluble ash (HNO ₃)	684 mg/gm
4	Acid Insoluble ash (HCL)	360 mg/gm
5	Acid Insoluble ash (HNO ₃)	252 mg/gm
6	Sodium	40.67 mg/gm
7	Potassium	350 mg/gm
8	Calcium	6.24 mg/gm

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PLATE-1 (Fig. 1-7)

CASSIA OCCIDENTALIS LINN.

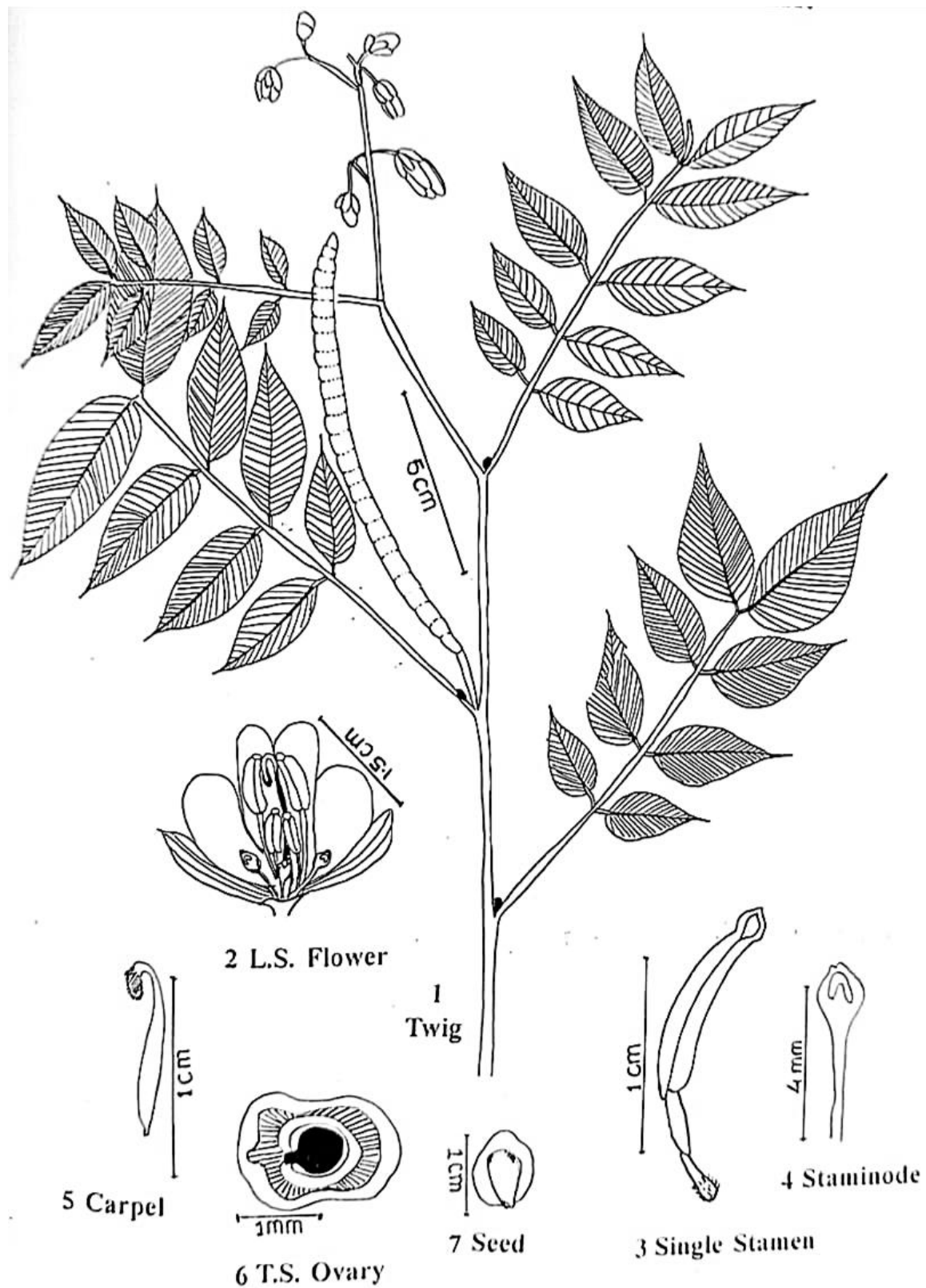
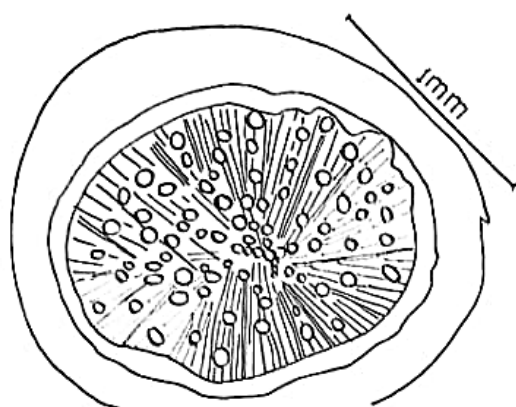
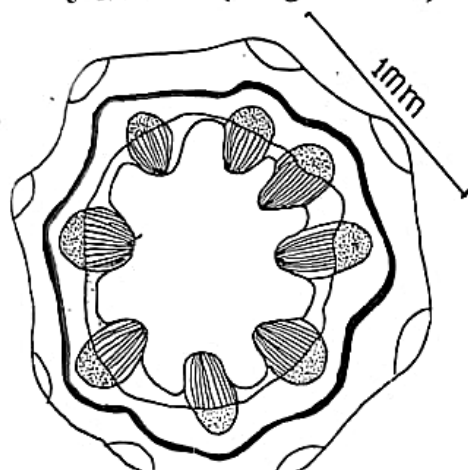


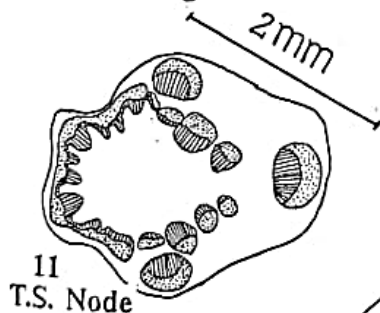
PLATE-2 (Fig. 8-12a,b,c)



8 T.S. Root (Diagrammatic)



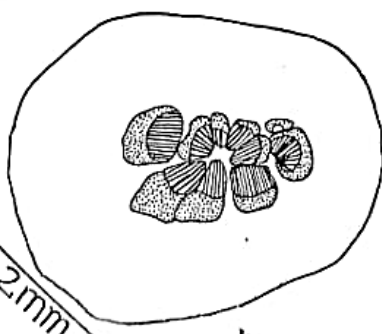
9 T. S. Young Stem (Diagrammatic)



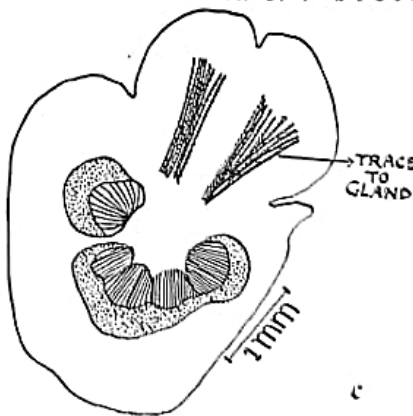
11
T.S. Node



a

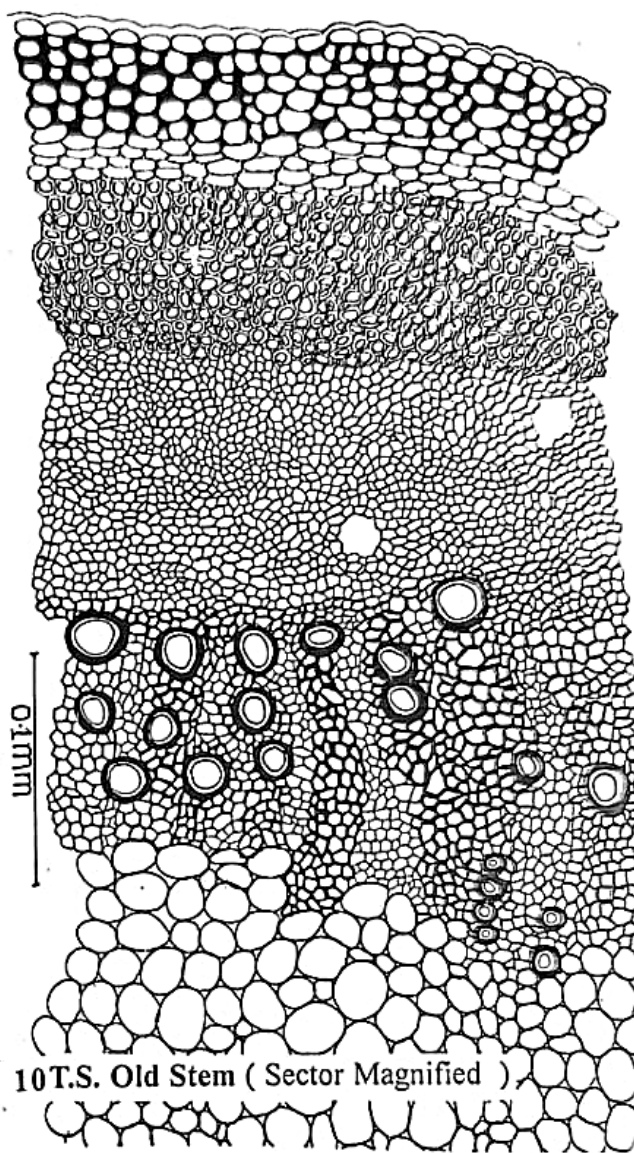


b



c

12 a - c T.S. Pulvinus



10 T.S. Old Stem (Sector Magnified)

PLATE-3 (13-21)

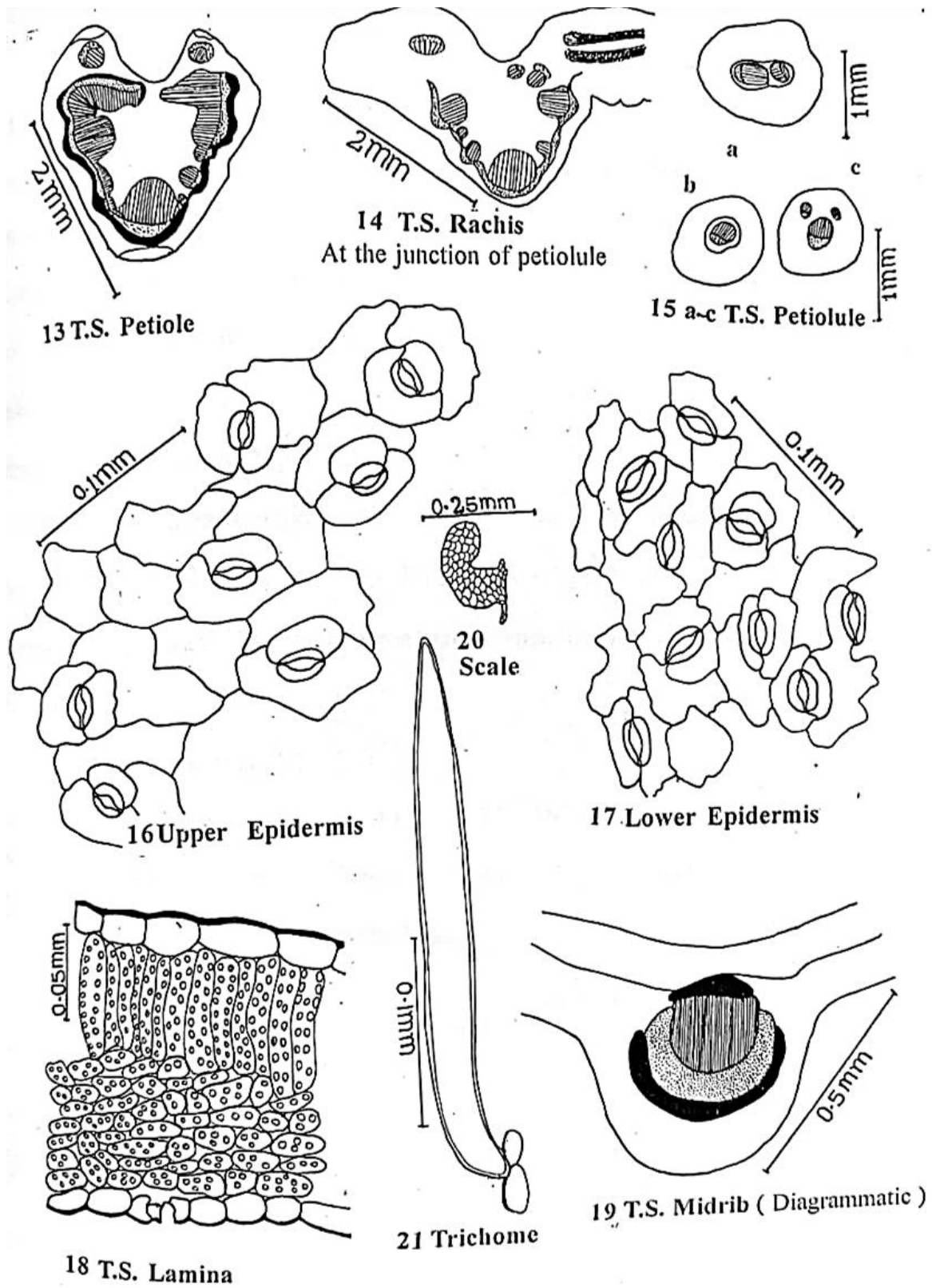


PLATE-4 (R1-3; S1-7)

